

F98

SQUIDs and Noise Thermometers

Figueroa, Q. & Huth, P. J.

January 5, 2025

- Physikalische Fragestellung
 - SQUIDs
 - Noise Thermometers
 - kurze theoretische Einleitung
- Messprinzip und Apparatur
- Vorstellung der Messergebnisse und deren Auswertung
- kritische Diskussion der Ergebnisse
- Anmerkung zum Versuch

- Question: How to measure the temperature of a system using noise.
- Answer: Using a SQUID.
Very sensitive magnetometers, consisting of superconducting loops interrupted by Josephson junctions.

What we measure and why

- ① Resistance at room temperature and in liquid Helium:
Observe the change in Resistance
- ② Current - Voltage characteristics $V - I$:
Estimate critical current I_C
- ③ Measure the $V - \Phi$ Characteristics:
Determine the inverse mutual inductance M_{IN}^{-1} and $M_{\Phi B}^{-1}$
- ④ Measure output resulting from periodic input signal:
Determine the amplification
- ⑤ Measure Noise at different GBP:
Finding an optimal value for the GBP
- ⑥ Measure Noise Spectrum with a two stage SQUID:
Calculate the temperature

- Superconductivity

Superconductivity:

Expulsion of magnetic fields from a superconductor below its critical temperature.

- Superconductivity
 - Meissner-Ochsenfeld effect

Meissner-Ochsenfeld Effect:

Expulsion of magnetic fields from a superconductor below its critical temperature.

- Josephson junction

Josephson junction:
Josephson junction

- Josephson junction
 - Flux quantization

Flux Quantization :

Flux quantization plays a role in the phase relationship between the two superconductors.

- Josephson junction
 - Cooper pairs

Cooper Pairs:

Cooper pairs tunnel through the insulating barrier, causing the Josephson effect.

SQUIDs: SQUIDs.

- SQUIDs

DC SQUID:

A superconducting quantum interference device with two Josephson junctions for measuring magnetic flux.

- SQUIDs
 - DC SQUID

- SQUIDs

- Flux locked loop

Flux Locked Loop:

A feedback loop that stabilizes the SQUID output by maintaining constant magnetic flux

Two-Stage SQUID:

Enhances sensitivity by using a primary SQUID amplified by a secondary stage.

- SQUIDs
 - Two-stage SQUID